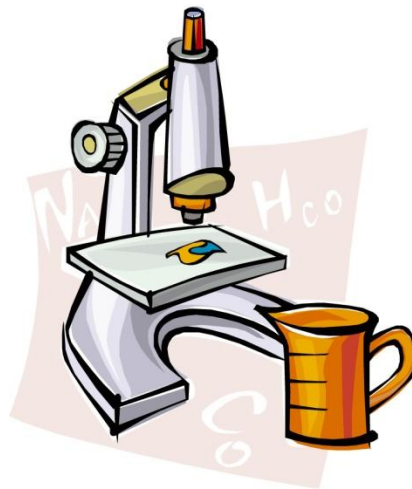


6th Grade Science Curriculum Essentials Document



Boulder Valley School District
Department of Curriculum and Instruction
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Introduction

Science Curriculum Essentials in BVSD

In 2009, the Colorado Department of Education published the most recent version of the Colorado Academic Standards.

This revision of the Boulder Valley School District Science Curriculum had three main goals:

- align with the revised Colorado Academic Standards
- maintain unique elements of our BVSD curriculum that reach beyond the standards
- maintain a viable list of concepts and skills that students should master in each grade level or course

Inquiry

A new organizational feature of the Colorado Academic Standards is the integration of science inquiry skills with specific scientific concepts. Instead of having a separate standard for inquiry, the skills associated with the process of scientific inquiry are embedded in the Evidence Outcomes for each Grade Level Expectation. In addition, the nature and history of science has been integrated into the Grade Level Expectations under "Nature of the Discipline". This approach is echoed by the *Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* which states that the skills or practices of inquiry and the core ideas "must be woven together in standards, curricula, instruction, and assessments."

Scientific inquiry remains a central focus of the revised BVSD Science Curriculum Essentials Documents. The following definition from the *National Science Education Standards* serves as the basis for our common understanding of how scientific inquiry is defined.

Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world.

The following points serve to clarify the vision of what inquiry means in BVSD.

Inquiry involves five essential features, which are heavily integrated into the wording of Evidence Outcomes in the Colorado Academic Standards. Students engaged in scientific inquiry should:

- ask or respond to scientifically oriented questions
 - give priority to evidence
 - formulate explanations based on evidence
 - connect explanations to scientific knowledge
 - communicate and justify explanations
- (*Inquiry and the National Science Education Standards*)

Inquiry based science instruction involves a continuum of learning experiences from teacher-led to learner self-directed activities, including but not limited to hand-on labs. Hence, both a structured assignment involving reading and written reflection and an open-ended, hands-on investigation could be considered inquiry as long as they involve the five essential features identified above.

The ultimate goals of inquiry-based instruction are to engage learners, develop their conceptual understanding of the natural world around them, and to overcome misconceptions in science.

Inquiry-based activities should balance students' application of content knowledge, creativity and critical thinking in order to analyze data, solve a problem or address a unique question.

6th Grade Overview

Course Description		Topics at a Glance	
<p>In middle level physical science, students will be designing and conducting scientific investigations and constructing scientific explanations based on evidence. Students will make measurements using metric units and will organize their data using bar and line graphs. Students will learn about fundamental concepts in physical science such as the particulate nature of matter, basic atomic structure, forms and sources of energy, energy transfer and transformations, the conservation of matter and energy, and force and motion. Students will also learn about the nature of science as a human endeavor.</p>		<ul style="list-style-type: none"> ● Forces and Motion ● Forms of Energy and Energy Transfer ● Conservation of Energy ● Physical and Chemical Changes ● Conservation of Mass ● States of Matter ● Waves ● Mixtures ● Atoms, Elements, Compounds and Molecules ● Properties of Matter 	
Assessments		Scientific, Technology & Information Literacy	
<ul style="list-style-type: none"> ● Teacher-created assessments 		<p>Middle Level Physical Science students:</p> <ul style="list-style-type: none"> - Create and conduct plans for scientific investigations that include: asking questions, stating hypotheses, identifying variables, identifying constants, and collecting data accurately. - Use appropriate tools, technology and measurement units to gather and organize data and to report results. - Interpret data and recognize bias in order to formulate logical conclusions. - Communicate the design and results of scientific investigations in appropriate ways (written, oral, graphical, pictorial, digital). - Follow lab and safety procedures when conducting scientific investigations. - Explain that a controlled experiment must have comparable results when repeated. - Create and use physical and conceptual models for explanations and predictions. - Recognize that people from different cultures and from different times in history make contributions to the advancement of science. - Recognize that the interrelationship of science and technology has implications for the social, cultural, and ecological systems within which we live. - Use technology responsibly for communication and transfer of ideas. - Use technology to gather, organize, analyze, and communicate about data. - Collaborate with others to identify information about problems and to seek solutions. - Create a labeled diagram that supports information being shared. - Organize and report information in a variety of complex ways including tables, graphs, charts, and reports. - Identify different information sources and assess reliability of sources. - Present information in a variety of formats including written paragraphs, posters, illustrations, oral reports, etc. 	
Grade Level Expectations			
Standard	Big Ideas for 6th Grade		
<p>1. Physical Science</p>	<ol style="list-style-type: none"> 1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion. 2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved. 3. Distinguish between physical and chemical changes, noting that mass is conserved during any change. 4. Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties. 5. Mixtures of substances can be separated based on their properties such as solubility, boiling points, magnetic properties, and densities. 6. All matter is made of atoms, which are far too small to see directly through a light microscope. Elements have unique atoms and thus, unique properties. Atoms themselves are made of even smaller particles. 7. Atoms may stick together in well-defined molecules or be packed together in large arrangements. Different arrangements of atoms into groups compose all substances. 8. The physical characteristics and changes of solid, liquid, and gas states can be explained using the particulate model. 9. Distinguish among, explain, and apply the relationships among mass, weight, volume, and density. 		

1. Physical Science

Students know and understand common properties, forms and changes in matter and energy.

Prepared Graduates

The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

Prepared Graduate Competencies in the Physical Science standard:

- Observe, explain, and predict natural phenomena governed by Newton's laws of motion, acknowledging the limitations of their application to very small or very fast objects
- Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions
- Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable
- *Engage in scientific inquiry by asking or responding to scientifically oriented questions, collecting and analyzing data, giving priority to evidence, formulating explanations based on evidence, connecting explanations to scientific knowledge, and communicating and justifying explanations.*

Content Area: Science - Sixth Grade	
Standard: 1. Physical Science	
Prepared Graduates: Observe, explain, and predict natural phenomena governed by Newton's laws of motion, acknowledging the limitations of their application to very small or very fast objects	
GRADE LEVEL EXPECTATION Concepts and skills students master: 1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Predict and evaluate the movement of an object by examining the forces applied to it <ul style="list-style-type: none"> • <i>Identify the forces acting on a moving object and explain the effects of changes in both magnitude and direction</i> b. Use mathematical expressions to describe the movement of an object <ul style="list-style-type: none"> • <i>Calculate velocity given distance and time</i> • Extension: Define and calculate acceleration given velocity and time • Extension: manipulate mathematical expressions to describe the movement (for example: solve for distance when given velocity and time) c. Develop and design a scientific investigation to collect and analyze speed and acceleration data to determine the net forces acting on a moving object <ul style="list-style-type: none"> • <i>Based on the size and direction of a force applied, determine the direction an object will move</i> 	Inquiry Questions: 1. What relationships exist among force, mass, speed, and acceleration? 2. What evidence indicates a force has acted on a system? Is it possible for a force to act on a system without having an effect?
	Relevance and Application: 1. Engineers take forces into account when designing moving objects such as car tires, roller coasters, and rockets. 2. Vehicles and their propulsion systems are designed by analyzing the forces that act on the vehicle. For example, the designs of propellers and jet engines are based on the aerodynamics of airplanes.
	Nature of Discipline: 1. Recognize that our current understanding of forces has developed over centuries of studies by many scientists, and that we will continue to refine our understanding of forces through continued scientific investigations and advances in data collection. 2. Find, evaluate, and select appropriate information from reference books, journals, magazines, online references, and databases to answer scientific questions about motion and acceleration.

Content Area: Science - Sixth Grade

Standard: 1. Physical Science

Prepared Graduates:

Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved

Evidence Outcomes	21st Century Skills and Readiness Competencies
<p>Students can:</p> <ul style="list-style-type: none">a. Gather, analyze, and interpret data to describe the different forms of energy and energy transferb. Develop a research-based analysis of different forms of energy and energy transferc. Use research-based models to describe energy transfer mechanisms, and predict amounts of energy transferred	<p>Inquiry Questions:</p> <ul style="list-style-type: none">1. Which forms of energy can be directly observed, and which forms of energy must be inferred?2. What evidence supports the existence of potential and kinetic energy?3. Is there a limit to how many times energy can be transferred? Explain your answer.
	<p>Relevance and Application:</p> <ul style="list-style-type: none">1. Photos and measurements of accident investigations provide evidence of energy transfers during such events.2. Kinetic energy often is turned into heat such as when brakes are applied to a vehicle or when space vehicles re-enter Earth’s atmosphere.3. Energy transfers convert electricity to light, heat, or kinetic energy in motors.4. There are ways of producing electricity using both nonrenewable resources such as coal or natural gas and renewable sources such as hydroelectricity or solar, wind, and nuclear power.
	<p>Nature of Discipline:</p> <ul style="list-style-type: none">1. Share experimental data, and respectfully discuss conflicting results.2. Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others.3. Use tools to gather, view, analyze, and report results for scientific investigations designed to answer questions about energy transformations.

Content Area: Science	
Standard: 1. Physical Science - Sixth Grade	
Prepared Graduates: Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions	
GRADE LEVEL EXPECTATION Concepts and skills students master: 3. Distinguish between physical and chemical changes, noting that mass is conserved during any change	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ol style="list-style-type: none"> a. Identify the distinguishing characteristics between a chemical and a physical change <ul style="list-style-type: none"> • <i>Define chemical change as a change in which existing substances react to form new substances with different properties</i> b. Gather, analyze, and interpret data on physical and chemical changes c. Gather, analyze, and interpret data that show mass is conserved in a given chemical or physical change d. Identify evidence that suggests that matter is always conserved in physical and chemical changes <ul style="list-style-type: none"> • <i>Explain that mass will remain the same in a closed system even if changes take place within the system</i> e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate physical and chemical changes f. Extension: Understand that a chemical equation describes a chemical change g. Extension: Count the atoms of different elements on both the reactant and product side of a chemical equation h. Extension: Balance a chemical equation using coefficients 	Inquiry Questions: <ol style="list-style-type: none"> 1. What evidence can indicate whether a change is physical or chemical? 2. Is it easier to observe the conservation of mass in physical or chemical changes? Why? 3. What would happen if mass were not conserved?
	Relevance and Application: <ol style="list-style-type: none"> 1. The freezing, thawing, and vaporization of Earth's water provide examples of physical changes. 2. An understanding of chemical changes has resulted in the design of various products such as refrigerants in air conditioners and refrigerators. 3. Physical and chemical changes are involved in the collection and refinement of natural resources such as using arsenic in gold mining. 4. Living systems conserve mass when waste products from some organisms are nutrients for others.
	Nature of Discipline: <ol style="list-style-type: none"> 1. Evaluate the reproducibility of an experiment, and critically examine conflicts in experimental results. 2. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.

Content Area: Science - Sixth Grade

Standard: 1. Physical Science

Prepared Graduates:

Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable

GRADE LEVEL EXPECTATION

Concepts and skills students master:

4. Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties

Evidence Outcomes	21st Century Skills and Readiness Competencies
<p>Students can:</p> <ul style="list-style-type: none">a. Compare and contrast different types of wavesb. Describe for various waves the amplitude, frequency, wavelength, and speedc. Describe the relationship between pitch and frequency in soundd. Develop and design a scientific investigation regarding absorption, reflection, and refraction of light	<p>Inquiry Questions:</p> <ul style="list-style-type: none">1. What are some different ways to describe waves?
	<p>Relevance and Application:</p> <ul style="list-style-type: none">1. Different vibrations create waves with different characteristics. For example, a vibrating low-pitch guitar string feels different to the touch than a high-pitch guitar string.2. Dealing with different types of waves presents design challenges. For example, higher frequency waves have shorter wavelengths, which affect ships, buildings, and antenna design.3. Energy from different types of waves can affect the environment. For example, natural waves cause different beach erosion than boat wakes.4. There are many applications of light and lasers such as using fiber optics in high speed communication and lasers in surgery.5. Living organisms collect and use light and sound waves – such as for hearing and vision – to gather information about their surroundings.
	<p>Nature of Discipline:</p> <ul style="list-style-type: none">1. Evaluate models used to explain and predict wave phenomena that cannot be directly measured.2. Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere. For example, the speed of light in a vacuum is constant across space and time.3. Select and use technology tools to gather, view, analyze, and report results for scientific investigations about the characteristics and properties of waves.

Content Area: Science - Sixth Grade	
Standard: 1. Physical Science	
Prepared Graduates: Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions	
GRADE LEVEL EXPECTATION Concepts and skills students master: 5. Mixtures of substances can be separated based on their properties such as solubility, boiling points, magnetic properties, and densities	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ol style="list-style-type: none"> a. Identify properties of substances in a mixture that could be used to separate those substances from each other b. Develop and design a scientific investigation to separate the components of a mixture 	Inquiry Questions: <ol style="list-style-type: none"> 1. What techniques can be used to separate mixtures of substances based their properties? 2. Which properties are the most useful in trying to separate mixtures of substances? 3. How much difference must there be among the properties of substances for the properties to be useful in separating the substances?
	Relevance and Application: <ol style="list-style-type: none"> 1. Materials are sorted based on their properties in a variety of applications. For example, water filtration systems rely on the solubility, density, and physical sizes of substances, and recycling facilities use the properties of materials to separate substances in single-stream recycling systems. 2. Mining and oil refining processes use properties to separate materials. 3. The kidneys use properties to filter wastes from the blood.
	Nature of Discipline: <ol style="list-style-type: none"> 1. Ask testable questions and make a falsifiable hypothesis about using properties to perform separations, and design a method to find an answer. 2. Evaluate and critique experimental procedures designed to separate mixtures. 3. Share experimental data, and respectfully discuss inconsistent results. 4. Describe several ways in which scientists would study mixtures, and suggest ways that this has contributed to our understanding of materials.

Content Area: Science - Sixth Grade	
Standard: 1. Physical Science	
Prepared Graduates: Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions	
GRADE LEVEL EXPECTATION	
Concepts and skills students master: 6. All matter is made of atoms, which are far too small to see directly through a light microscope. Elements have unique atoms and thus, unique properties. Atoms themselves are made of even smaller particles	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ol style="list-style-type: none"> a. Identify evidence that suggests there is a fundamental building block of matter <ul style="list-style-type: none"> • <i>Explain all matter is comprised of atoms</i> b. Use the particle model of matter to illustrate characteristics of different substances <ul style="list-style-type: none"> • <i>Describe the relative location, charge, and mass of subatomic particles (protons, neutrons, and electrons)</i> • <i>Explain how number of protons in an atom determines what element it is</i> • <i>Predict how the atomic structure affects properties of elements</i> • <i>Identify the basic parts of an entry in the Periodic Table</i> • <i>Collect and apply information from the Periodic Table to elements (determine number of protons, electrons, and neutrons and atomic mass)</i> c. Develop an evidence based scientific explanation of the atomic model as the foundation for all chemistry d. Find and evaluate appropriate information from reference books, journals, magazines, online references, and databases to compare and contrast historical explanations for the nature of matter <ul style="list-style-type: none"> • <i>Understand people of different times and places contributed to the development of modern atomic theory (Dalton, Rutherford, Thomson, Bohr, etc)</i> e. Extension: Explain atoms of the same element that have the same number of protons but different numbers of neutrons are called isotopes. 	Inquiry Questions: <ol style="list-style-type: none"> 1. In the world of science what makes something a building block?
	Relevance and Application: <ol style="list-style-type: none"> 1. Living things consist of the same matter as the rest of the universe.
	Nature of Discipline: <ol style="list-style-type: none"> 1. Work in groups using the writing process to effectively communicate an understanding of the particle model of matter. 2. Use technology to share research findings about historical explanations for the nature of matter and to publish information to various audiences. 3. Create models that explain the particle theory of matter. 4. Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing others work.

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| <ul style="list-style-type: none">f. Extension: Calculate average atomic mass using isotopic masses and abundancesg. Extension: Use Bohr models to show electron configurationh. Extension: Apply classification systems to other groups of objects by making new Periodic Tablesi. Extension: Describe periodic trends on the Periodic Table | |
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Content Area: Science - Sixth Grade	
Standard: 1. Physical Science	
Prepared Graduates: Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions	
GRADE LEVEL EXPECTATION Concepts and skills students master: 7. Atoms may stick together in well-defined molecules or be packed together in large arrays. Different arrangements of atoms into groups compose all substances	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ol style="list-style-type: none"> a. Explain the similarities and differences between elements and compounds <ul style="list-style-type: none"> • <i>Two or more atoms chemically combine to form a molecule</i> • <i>Molecules are represented by a chemical formula that show the ratio of each element in the molecule</i> b. Identify evidence suggesting that atoms form into molecules with different properties than their components <ul style="list-style-type: none"> • <i>The smallest unit of a compound that still retains the properties of the compound is a molecule</i> • <i>A compound is chemically bonded while a mixture is physically mixed</i> c. Find and evaluate information from a variety of resources about molecules d. Extension: Count the number of atoms in a molecule using subscripts and coefficients e. Extension: Recognize the shape and chemical formula for common compounds on Earth and in the atmosphere (water, carbon dioxide, ozone, carbon monoxide, nitrogen, oxygen, etc.) 	Inquiry Questions: <ol style="list-style-type: none"> 1. Why do substances behave differently? For example, why does water pour rapidly while syrup pours slowly?
	Relevance and Application: <ol style="list-style-type: none"> 1. Different arrangements of atoms provide different properties. 2. Very small devices consist of large numbers of arranged groups of atoms that perform a specific function.
	Nature of Discipline: <ol style="list-style-type: none"> 1. Use models and/or electronic media to show and understand how molecules are made of atoms. 2. Investigate how our current understanding of matter has developed through centuries of scientific investigations.

Content Area: Science - Sixth Grade		
Standard: 1. Physical Science		
Prepared Graduates: Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions		
GRADE LEVEL EXPECTATION		
Concepts and skills students master: 8. The physical characteristics and changes of solid, liquid, and gas states can be explained using the particulate model		
Evidence Outcomes	21st Century Skills and Readiness Competencies	
Students can: <ol style="list-style-type: none"> a. Explain how the arrangement and motion of particles in a substance, such as water, determine its state <ul style="list-style-type: none"> • Describe and identify the properties of solids, liquids, and gases • Describe the arrangement, motion, and energy of particles in different states b. Distinguish between changes in temperature and changes of state using the particle model of matter <ul style="list-style-type: none"> • Identify the names and processes of changes in state • Predict how changes in temperature affect behavior of particles • Use the particulate model to explain the changes in energy and molecular motion in transitions between solids, liquids, and gases • Measure temperature using a thermometer and appropriate units c. Extension: Explore additional states of matter, such as plasma, Bose-Einstein Condensate, etc. d. Extension: Investigate Ideal Gas Law and use mathematical expressions to predict changes in pressure, volume, and temperature. e. Extension: Interpret phase diagrams for different types of matter f. Extension: Design experiments to test hypotheses about changes in state for different types of matter 	Inquiry Questions: <ol style="list-style-type: none"> 1. What determines whether matter is in the form of a solid, liquid, or gas? 2. What is the kinetic molecular theory, and how does temperature affect the behavior of particles in a gas? 	
		Relevance and Application: <ol style="list-style-type: none"> 1. Solids, liquids, and gasses all have unique properties that make them useful in different situations. For example, solids are useful building materials.
		Nature of Discipline: <ol style="list-style-type: none"> 1. Use models and technology tools to help visualize what is happening at the molecular level during phase changes. 2. Understand and apply the difference between scientific laws, theories and hypotheses. 3. Work in groups using the writing process to communicate an understanding how the particle model of matter explains various states of matter.

Content Area: Science - Sixth Grade	
Standard: 1. Physical Science	
Prepared Graduates: Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions	
GRADE LEVEL EXPECTATION Concepts and skills students master: 9. Distinguish among, explain, and apply the relationships among mass, weight, volume, and density	
Evidence Outcomes	21st Century Skills and Readiness Competencies
<p>Students can:</p> <ol style="list-style-type: none"> a. Explain that the mass of an object does not change, but its weight changes based on the gravitational forces acting upon it <ul style="list-style-type: none"> • <i>Define mass, volume, weight, density, and gravity</i> • <i>Distinguish between mass and weight</i> b. Predict how changes in acceleration due to gravity will affect the mass and weight of an object c. Predict how mass, weight, and volume affect density d. Measure mass and volume, and use these quantities to calculate density <ul style="list-style-type: none"> • <i>Use appropriate units for listed quantities</i> • <i>Predict how relative density affects the ability of a sample to float or sink in a liquid of known density</i> e. Use tools to gather, view, analyze, and report results for scientific investigations about the relationships among mass, weight, volume, and density <ul style="list-style-type: none"> • <i>Use a balance, graduated cylinder, scale, and metric ruler</i> f. Extension: Calculate force of gravity on objects using acceleration and mass g. Extension: Explore Newton's Law of Universal Gravitation and explain how mass and distance affect gravitational pull between two objects h. Extension: Describe inertia and how inertia relates to mass 	<p>Inquiry Questions:</p> <ol style="list-style-type: none"> 1. Which of the following is the best recommendation for a person trying to lose weight and why? <ul style="list-style-type: none"> ○ Reduce the number of calories he or she eats. ○ Exercise more. ○ Go to the Moon. 2. If weight and mass are not the same thing, why might people use the words interchangeably? 3. Describe a situation in which mass would be the most useful information to know about an object? Do the same for weight, volume, and density. <p>Relevance and Application:</p> <ol style="list-style-type: none"> 1. Mass, weight, and gravitational forces are critical for space travel, future visits to outer space, and possibly the colonization of places like the Moon or Mars. <p>Nature of Discipline:</p> <ol style="list-style-type: none"> 1. Calculate the density of a sample, predict its ability to float or sink in a liquid of known density, design and perform the experiment, and justify discrepancies in the experimental outcome. 2. Ask testable questions, make a falsifiable hypothesis about density and design an inquiry based method to find an answer. 3. Select proper tools to measure the mass and volume of an object and use appropriate units.

Prepared Graduate Competencies in Science

The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

Prepared Graduates:

- Observe, explain, and predict natural phenomena governed by Newton's laws of motion, acknowledging the limitations of their application to very small or very fast objects
- Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions
- Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable
- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection
- Explain and illustrate with examples how living systems interact with the biotic and abiotic environment
- Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment
- Explain how biological evolution accounts for the unity and diversity of living organisms
- Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet
- Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system
- Describe how humans are dependent on the diversity of resources provided by Earth and Sun
- *Engage in scientific inquiry by asking or responding to scientifically oriented questions, collecting and analyzing data, giving priority to evidence, formulating explanations based on evidence, connecting explanations to scientific knowledge, and communicating and justifying explanations.*

Standard**Grade Level Expectation**

High School	
1. Physical Science	<ol style="list-style-type: none">1. Newton's laws of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion – but have limitations2. Matter has definite structure that determines characteristic physical and chemical properties3. Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy4. Atoms bond in different ways to form molecules and compounds that have definite properties5. Energy exists in many forms such as mechanical, chemical, electrical, radiant, thermal, and nuclear, that can be quantified and experimentally determined6. When energy changes form, it is neither created nor destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases
2. Life Science	<ol style="list-style-type: none">1. Matter tends to be cycled within an ecosystem, while energy is transformed and eventually exits an ecosystem2. The size and persistence of populations depend on their interactions with each other and on the abiotic factors in an ecosystem3. Cellular metabolic activities are carried out by biomolecules produced by organisms4. The energy for life primarily derives from the interrelated processes of photosynthesis and cellular respiration. Photosynthesis transforms the sun's light energy into the chemical energy of molecular bonds. Cellular respiration allows cells to utilize chemical energy when these bonds are broken.5. Cells use the passive and active transport of substances across membranes to maintain relatively stable intracellular environments6. Cells, tissues, organs, and organ systems maintain relatively stable internal environments, even in the face of changing external environments7. Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins8. Multicellularity makes possible a division of labor at the cellular level through the expression of select genes, but not the entire genome9. Evolution occurs as the heritable characteristics of populations change across generations and can lead populations to become better adapted to their environment

Standard	Grade Level Expectation
High School (continued)	
3. Earth Systems Science	<ol style="list-style-type: none"> 1. The history of the universe, solar system and Earth can be inferred from evidence left from past events 2. As part of the solar system, Earth interacts with various extraterrestrial forces and energies such as gravity, solar phenomena, electromagnetic radiation, and impact events that influence the planet's geosphere, atmosphere, and biosphere in a variety of ways 3. The theory of plate tectonics helps to explain geological, physical, and geographical features of Earth 4. Climate is the result of energy transfer among interactions of the atmosphere, hydrosphere, geosphere, and biosphere 5. There are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources 6. The interaction of Earth's surface with water, air, gravity, and biological activity causes physical and chemical changes 7. Natural hazards have local, national and global impacts such as volcanoes, earthquakes, tsunamis, hurricanes, and thunderstorms
Eighth Grade	
3. Earth Systems Science	<ol style="list-style-type: none"> 1. Weather is a result of complex interactions of Earth's atmosphere, land and water, that are driven by energy from the sun, and can be predicted and described through complex models 2. Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location 3. The solar system is comprised of various objects that orbit the Sun and are classified based on their characteristics 4. The relative positions and motions of Earth, Moon, and Sun can be used to explain observable effects such as seasons, eclipses, and Moon phases 5. Major geologic events such as earthquakes, volcanic eruptions, mid-ocean ridges, and mountain formation are associated with plate boundaries and attributed to plate motions 6. Geologic time, history, and changing life forms are indicated by fossils and successive sedimentation, folding, faulting, and uplifting of layers of sedimentary rock 7. Complex interrelationships exist between Earth's structure and natural processes that over time are both constructive and destructive 8. Water on Earth is distributed and circulated through oceans, glaciers, rivers, ground water, and the atmosphere 9. Earth's natural resources provide the foundation for human society's physical needs. Many natural resources are nonrenewable on human timescales, while others can be renewed or recycled

Standard	Grade Level Expectation
Seventh Grade	
2. Life Science	<ol style="list-style-type: none"> 1. Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment 2. The human body is composed of atoms, molecules, cells, tissues, organs, and organ systems that have specific functions and interactions 3. Cells are the smallest unit of life that can function independently and perform all the necessary functions of life 4. Photosynthesis and cellular respiration are important processes by which energy is acquired and utilized by organisms 5. Multiple lines of evidence show the evolution of organisms over geologic time 6. Human activities can deliberately or inadvertently alter ecosystems and their resiliency 7. Organisms reproduce and transmit genetic information (genes) to offspring, which influences individuals' traits in the next generation 8. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species 9. Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem
Sixth Grade	
1. Physical Science	<ol style="list-style-type: none"> 1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion 2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved 3. Distinguish between physical and chemical changes, noting that mass is conserved during any change 4. Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties 5. Mixtures of substances can be separated based on their properties such as solubility, boiling points, magnetic properties, and densities 6. All matter is made of atoms, which are far too small to see directly through a light microscope. Elements have unique atoms and thus, unique properties. Atoms themselves are made of even smaller particles 7. Atoms may stick together in well-defined molecules or be packed together in large arrangements. Different arrangements of atoms into groups compose all substances. 8. The physical characteristics and changes of solid, liquid, and gas states can be explained using the particulate model 9. Distinguish among, explain, and apply the relationships among mass, weight, volume, and density

Standard	Grade Level Expectation
Fifth Grade	
1. Physical Science	1. Mixtures of matter can be separated regardless of how they were created; all weight and mass of the mixture are the same as the sum of weight and mass of its parts
2. Life Science	1. All organisms have structures and systems with separate functions 2. Human body systems have basic structures, functions, and needs
3. Earth Systems Science	1. Earth and sun provide a diversity of renewable and nonrenewable resources 2. Earth's surface changes constantly through a variety of processes and forces 3. Weather conditions change because of the uneven heating of Earth's surface by the Sun's energy. Weather changes are measured by differences in temperature, air pressure, wind and water in the atmosphere and type of precipitation
Fourth Grade	
1. Physical Science	1. Energy comes in many forms such as light, heat, sound, magnetic, chemical, and electrical
2. Life Science	1. All living things share similar characteristics, but they also have differences that can be described and classified 2. Comparing fossils to each other or to living organisms reveals features of prehistoric environments and provides information about organisms today 3. There is interaction and interdependence between and among living and nonliving components of systems
3. Earth Systems Science	1. Earth is part of the solar system, which includes the Sun, Moon, and other bodies that orbit the Sun in predictable patterns that lead to observable paths of objects in the sky as seen from Earth
Third Grade	
1. Physical Science	1. Matter exists in different states such as solids, liquids, and gases and can change from one state to another by heating and cooling
2. Life Science	1. The duration and timing of life cycle events such as reproduction and longevity vary across organisms and species
3. Earth Systems Science	1. Earth's materials can be broken down and/or combined into different materials such as rocks, minerals, rock cycle, formation of soil, and sand – some of which are usable resources for human activity
Second Grade	
1. Physical Science	1. Changes in speed or direction of motion are caused by forces such as pushes and pulls.
2. Life Science	1. Organisms depend on their habitat's nonliving parts to satisfy their needs 2. Each plant or animal has different structures or behaviors that serve different functions
3. Earth Systems Science	1. Weather and the changing seasons impact the environment and organisms such as humans, plants, and other animals

Standard	Grade Level Expectation
First Grade	
1. Physical Science	1. Solids and liquids have unique properties that distinguish them
2. Life Science	1. Offspring have characteristics that are similar to but not exactly like their parents' characteristics 2. An organism is a living thing that has physical characteristics to help it survive
3. Earth Systems Science	1. Earth's materials can be compared and classified based on their properties
Kindergarten	
1. Physical Science	1. Objects can move in a variety of ways that can be described by speed and direction 2. Objects can be sorted by physical properties, which can be observed and measured
2. Life Science	1. Organisms can be described and sorted by their physical characteristics
3. Earth Systems Science	1. The sun provides heat and light to Earth
Preschool	
1. Physical Science	1. Objects have properties and characteristics 2. There are cause-and-effect relationships in everyday experiences
2. Life Science	1. Living things have characteristics and basic needs 2. Living things develop in predictable patterns
3. Earth Systems Science	1. Earth's materials have properties and characteristics that affect how we use those materials 2. Events such as night, day, the movement of objects in the sky, weather, and seasons have patterns

Academic Vocabulary

absorption, acceleration, amplitude, array, atom, boiling point, chemical change, compound, conservation of energy, conservation of mass, density, electromagnetic wave, element, energy, energy transfer, energy transformation, falsifiable, force, frequency, gravity, hypothesis, infer, kinetic energy, kinetic molecular theory, light, light microscope, magnitude, mass, matter, mixture, molecule, net force, non-renewable, particle, particulate model, phase change, physical change, pitch (sound), potential energy, property, reflection, refraction, renewable, scientific law, scientific theory, seismic wave, separate, sound wave, speed, state of matter, substance, system, temperature, unique, volume, wave, wavelength, weight

Word	Definition
absorption	a reduction of the intensity of any form of radiated energy as a result of energy conversion in a medium, such as the conversion of sound energy into heat
acceleration	the rate of increase of speed
amplitude	in a wave, the maximum extent of a vibration or oscillation from the point of equilibrium.
array	an orderly or regular arrangement
atom	the smallest particle of a chemical element, consisting of a positively charged nucleus surrounded by negatively charged electrons
boiling point	the temperature at which a liquid boils at a fixed pressure, especially under standard atmospheric conditions
chemical change	a change in which the substances present at the beginning of the change are not present at the end; new substances are formed. The change cannot be "undone".
compound	a pure, macroscopically homogeneous substance consisting of atoms or ions of two or more different elements in definite proportions that cannot be separated by physical means. A compound usually has properties unlike those of its constituent elements
conservation of energy	a principle stating that the total energy of an isolated system remains constant regardless of changes within the system
conservation of mass	a principle in classical physics stating that the total mass of an isolated system is unchanged by interaction of its parts
density	the mass of a substance per unit volume
electromagnetic wave	wave of energy having a frequency within the electromagnetic spectrum and propagated as a periodic disturbance of the electromagnetic field when an electric charge oscillates or accelerates
element	substance composed of atoms having an identical number of protons in each nucleus
energy	the capacity of a physical system to do work
energy transfer	to pass energy from one place or thing to another
energy transformation	to convert energy from one form to another
force	an influence tending to change the motion of a body or produce motion or stress in a stationary body; a push or a pull
falsifiable	able to be proven false, and therefore testable
frequency	the number of repetitions per unit time of a complete waveform
gravity	the force that attracts a body towards the center of the earth, or towards any other physical body having mass

hypothesis	a tentative explanation for an observation
infer	draw conclusions, interpret, or try to explain observations
kinetic energy	the energy possessed by an object because of its motion
kinetic molecular theory	Theory that describes a gas as a large number of small particles (atoms or molecules), all of which are in constant, random motion . Kinetic theory explains macroscopic properties of gases, such as pressure, temperature, or volume, by considering their molecular composition and motion.
light	electromagnetic radiation that can produce a visual sensation
light microscope	microscope consisting of an optical instrument that magnifies the image of an object
magnitude	relative size or extent
mass	the quantity of matter which a body contains, as measured by its acceleration under a given force or by the force exerted on it by a gravitational field
matter	physical substance or material in general; that which occupies space and possesses mass
mixture	a composition of two or more substances that are not chemically combined with each other and are capable of being separated
molecule	the simplest unit of a chemical compound that can exist, consisting of two or more atoms held together by chemical bonds
net force	the overall force on an object when all the individual forces are acting on an object and then added together
non-renewable	of or relating to an energy source, such as oil or natural gas, or a natural resource, such as a metallic ore, that is not replaceable after it has been used
particle	a very small piece of matter
particulate model	model of matter describing all matter as composed of particles with space in between them; the relative distance between particles and the motion of the particles can be used to explain the phases of matter (gas, liquid, solid)
phase change	a change from one state (solid or liquid or gas) to another without a change in chemical composition
physical change	type of change in which the form of matter is altered but one substance is not transformed into another
pitch (sound)	the property of sound that varies with variation in the frequency of vibration; how "low" or "high" a sound is
potential energy	stored energy; the ability of a system to do work due to its position or internal structure. For example, gravitational potential energy is a stored energy determined by an object's position in a gravitational field while elastic potential energy is the energy stored in a spring.
property	something that can be known about an object by using one of the five senses, either directly or by using tools such a microscope
reflection	the throwing back by a body or surface of light, heat, or sound without absorbing it
refraction	phenomenon of light, radio waves, etc., being deflected in passing obliquely through the interface between one medium and another or through a medium of varying density
renewable	any natural resource (as wood or solar energy) that can be replenished naturally with the passage of time
scientific law	a statement of a principle or generalized pattern that appears to be without exception at the time it is made, and has become consolidated by repeated successful testing

scientific theory	an explanation for an observation or series of observations that is substantiated by a considerable body of evidence
seismic wave	wave of force that travels through the Earth or other elastic body, for example as a result of an earthquake, explosion, or some other process that imparts forces
separate	to remove parts of mixture; isolate; pull apart into distinct units
sound wave	longitudinal waves of mechanical energy that transmit vibrations interpreted as sound
speed	the rate or a measure of the rate of motion
state of matter	the physical state that matter exists in; solid, liquid or gas
substance	a particular kind of matter with uniform properties
system	a group of interacting, interrelated, or interdependent elements forming a complex whole
temperature	a measure of the average kinetic energy of the particles in a sample of matter, expressed in terms of units or degrees designated on a standard scale
unique	being the only one of its kind:
volume	the amount of 3-dimensional space occupied by an object
wave	a disturbance traveling through a medium by which energy is transferred from one particle of the medium to another without causing any permanent displacement of the medium itself.
wavelength	the distance between one peak or crest of a wave of light, heat, or other energy and the next corresponding peak or crest
weight	the force with which a body is attracted to Earth or another celestial body, equal to the product of the object's mass and the acceleration of gravity



CAN DO Descriptors: Grade Level Cluster 6-8

For the given level of English language proficiency and with visual, graphic, or interactive support through Level 4, English language learners can process or produce the **language** needed to:

	Level 1 Entering	Level 2 Beginning	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 - Reaching
LISTENING	<ul style="list-style-type: none"> Follow one-step oral commands/instructions Match social language to visual/graphic displays Identify objects, people, or places from oral statements/questions using gestures (e.g., pointing) Match instructional language with visual representation (e.g., "Use a sharpened pencil.") 	<ul style="list-style-type: none"> Follow multi-step oral commands/instructions Classify/sort content-related visuals per oral descriptions Sequence visuals per oral directions Identify information on charts or tables based on oral statements 	<ul style="list-style-type: none"> Categorize content-based examples from oral directions Match main ideas of familiar text read aloud to visuals Use learning strategies described orally Identify everyday examples of content-based concepts described orally Associate oral language with different time frames (e.g., past, present, future) 	<ul style="list-style-type: none"> Identify main ideas and details of oral discourse Complete content-related tasks or assignments based on oral discourse Apply learning strategies to new situations Role play, dramatize, or re-enact scenarios from oral reading 	<ul style="list-style-type: none"> Use oral information to accomplish grade-level tasks Evaluate intent of speech and act accordingly Make inferences from grade-level text read aloud Discriminate among multiple genres read orally 	
SPEAKING	<ul style="list-style-type: none"> Answer yes/no and choice questions Begin to use general and high frequency vocabulary Repeat words, short phrases, memorized chunks Answer select WH-questions (e.g., "who," "what," "when," "where") within context of lessons or personal experiences 	<ul style="list-style-type: none"> Convey content through high frequency words/phrases State big/main ideas of classroom conversation Describe situations from modeled sentences Describe routines and everyday events Express everyday needs and wants Communicate in social situations Make requests 	<ul style="list-style-type: none"> Begin to express time through multiple tenses Retell/rephrase ideas from speech Give brief oral content-based presentations State opinions Connect ideas in discourse using transitions (e.g., "but," "then") Use different registers inside and outside of class State big/main ideas with some supporting details Ask for clarification (e.g., self-monitor) 	<ul style="list-style-type: none"> Paraphrase and summarize ideas presented orally Defend a point of view Explain outcomes Explain and compare content-based concepts Connect ideas with supporting details/evidence Substantiate opinions with reasons and evidence 	<ul style="list-style-type: none"> Defend a point of view and give reasons Use and explain metaphors and similes Communicate with fluency in social and academic contexts Negotiate meaning in group discussions Discuss and give examples of abstract, content-based ideas (e.g., democracy, justice) 	

The CAN DO Descriptors work in conjunction with the WIDA Performance Definitions of the English language proficiency standards. The Performance Definitions use three criteria (1. linguistic complexity; 2. vocabulary usage; and 3. language control) to describe the increasing quality and quantity of students' language processing and use across the levels of language proficiency.



CAN DO Descriptors: Grade Level Cluster 6-8

For the given level of English language proficiency and with visual, graphic, or interactive support through Level 4, English language learners can process or produce the **language** needed to:

	Level 1 Entering	Level 2 Beginning	Level 3 Developing	Level 4 Expanding	Level 5 Bridging
READING	<ul style="list-style-type: none"> Associate letters with sounds and objects Match content-related objects/pictures to words Identify common symbols, signs, and words Recognize concepts of print Find single word responses to WH- questions (e.g., “who,” “what,” “when,” “where”) related to illustrated text Use picture dictionaries/illustrated glossaries 	<ul style="list-style-type: none"> Sequence illustrated text of fictional and non-fictional events Locate main ideas in a series of simple sentences Find information from text structure (e.g., titles, graphs, glossary) Follow text read aloud (e.g., tapes, teacher, paired-readings) Sort/group pre-taught words/phrases Use pre-taught vocabulary (e.g., word banks) to complete simple sentences Use L1 to support L2 (e.g., cognates) Use bilingual dictionaries and glossaries 	<ul style="list-style-type: none"> Identify topic sentences, main ideas, and details in paragraphs Identify multiple meanings of words in context (e.g., “cell,” “table”) Use context clues Make predictions based on illustrated text Identify frequently used affixes and root words to make/extract meaning (e.g., “un-,” “re-,” “-ed”) Differentiate between fact and opinion Answer questions about explicit information in texts Use English dictionaries and glossaries 	<ul style="list-style-type: none"> Order paragraphs Identify summaries of passages Identify figurative language (e.g., “dark as night”) Interpret adapted classics or modified text Match cause to effect Identify specific language of different genres and informational texts Use an array of strategies (e.g., skim and scan for information) 	<ul style="list-style-type: none"> Differentiate and apply multiple meanings of words/phrases Apply strategies to new situations Infer meaning from modified grade-level text Critique material and support argument Sort grade-level text by genre
WRITING	<ul style="list-style-type: none"> Draw content-related pictures Produce high frequency words Label pictures and graphs Create vocabulary/concept cards Generate lists from pre-taught words/phrases and word banks (e.g., create menu from list of food groups) 	<ul style="list-style-type: none"> Complete pattern sentences Extend “sentence starters” with original ideas Connect simple sentences Complete graphic organizers/forms with personal information Respond to yes/no, choice, and some WH- questions 	<ul style="list-style-type: none"> Produce short paragraphs with main ideas and some details (e.g., column notes) Create compound sentences (e.g., with conjunctions) Explain steps in problem-solving Compare/contrast information, events, characters Give opinions, preferences, and reactions along with reasons 	<ul style="list-style-type: none"> Create multiple-paragraph essays Justify ideas Produce content-related reports Use details/examples to support ideas Use transition words to create cohesive passages Compose intro/body/conclusion Paraphrase or summarize text Take notes (e.g., for research) 	<ul style="list-style-type: none"> Create expository text to explain graphs/charts Produce research reports using multiple sources/citations Begin using analogies Critique literary essays or articles

Level 6 - Reading

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